Claims

1. Method for determination of the transmission behavior of an optical waveguide by means of ray tracing, with the following features:

- The spatial representation of the optical waveguide is undertaken as spatial combination of two or more guide pieces with an analytically representable surface, for which in each case an analytical method for determination of the intersection points of a spatial straight line with the surface is produced;
- The transmission behavior is determined by the ray tracing of a test ray, by determining intersection points of the test ray with the surface of the guide pieces until such time as an intersection point is found which belongs to a real material transition.

2. Method according to claim 1, with the determination as to whether a real material transition is present being undertaken as follows:

- Initially all intersection points of the test ray with the surfaces of all guide pieces are determined;
- These intersection points are sorted in ascending order of ray direction and investigated in this order, starting from the origin;
- If the origin is located outside the optical waveguide, the first intersection point found is one with a real material transition;
- Otherwise the angle between the normal to the surface of the associated waveguide section and ray direction is used to determine whether an entry or exit is present in the guide piece;
- A real material transition is present if an intersection point is reached in which, for each entry in a part piece,

an exit has also occurred with predetermined entries initially being set in accordance with the position of the origin.

3. Method according to claim 1, with the determination as to whether a real material transition is present being undertaken as follows:

- Initially all intersection points of the test ray with the surfaces of all guide pieces are determined;
- These interfaces are sorted in ascending order of ray direction and investigated in this order, starting from the origin;
- If the origin is located outside the optical waveguide, the first intersection point found is one with a real material transition;
- Otherwise for each intersection point one further test point in each case in the direction of the ray and opposite to the direction of the ray is investigated as to whether it lies inside one of the part pieces; if the result is different for the two test points, a material transition is present.

4. Method according to claim 1, with the determination as to whether a real material transition is present being undertaken as follows:

- For the guide pieces intersection points of the test ray with the surface of the guide piece are determined successively and investigated with the subsequent steps;
- For each intersection point one test point in each case in the same direction and in the opposite direction to the ray is determined with a small predetermined distance from the intersection point;
- Each of these test points is investigated to see whether it lies inside one of the part pieces; if the result is

different for the two test points, a material transition is present.

5. Method according to claim 3 with the following modification:

- The normals to the surface are used to determine the direction in which there is an exit from the part piece and a test point is determined in this direction; if it does not lie within another guide piece, a material transition is present.

6. Method according to claim 1, with the determination as to whether a real material transition is present being undertaken as follows:

- Initially all intersection points of the test ray with the surfaces of all guide pieces are determined;
- These interfaces are sorted in ascending order of ray direction and investigated in this order, starting from the origin;
- For each intersection point it is determined whether it lies inside one of the other part pieces; if this is not the case, a material transition is present.

7. Device for simulation of optical waveguides in which one of the methods in accordance with one of the previous claims is used.